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EXAMINER

NGUYEN, MICHELLE P

ART UNIT	PAPER NUMBER
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2851

DATE MAILED: 04/07/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Applicant(s)

09/734,062

Examiner

Michelle Nguyen

Applicant(s)

AUSSCHNITT ET AL.

Art Unit

2851

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-23 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-23 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 11 December 2000 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). ____.
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2. 6) ☐ Other: ____.

DETAILED ACTION

Specification

1. The abstract of the disclosure is objected to because it exceeds 150 words in length. Further, on page 29, line 7, "comprises" should be --includes-- or --has--.
Correction is required. See MPEP § 608.01(b).

Drawings

2. The drawings are objected to for the following reasons:
 - (a) They fail to comply with 37 CFR 1.84(p)(4) because reference character "16" has been used to designate both opaque segments and mask portions (see Fig. 2).
 - (b) They fail to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: 20a, 40, P.

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Objections

3. Claims 1, 3, 4, 7, 9, 12, 13 and 22 are objected to for the following reason:
 - (a) In claim 1, lines 14-15, "elements having a width and a length, the width of the outer elements" should be --elements, each having a width and a length, the widths of the outer elements--.

- (b) Claim 1 recites the limitation “the resulting printed second target portion width” in lines 19-20. There is insufficient antecedent basis for this limitation in the claim.
- (c) In claim 3, line 1, “arrays” should be --array--.
- (d) In claim 3, line 2, “sensitive” should be deleted.
- (e) Claim 3 recites the limitation “the imaging system” in lines 2-3. There is insufficient antecedent basis for this limitation in the claim.
- (f) In claim 4, line 2, “width” should be --widths--.
- (g) Claim 7 recites the limitation “the resulting printed second target portion width” in lines 19-20. There is insufficient antecedent basis for this limitation in the claim.
- (h) In claim 9, line 1, “arrays” should be --array--.
- (i) Claim 9 recites the limitation “the imaging system” in line 3. There is insufficient antecedent basis for this limitation in the claim.
- (j) In claim 12, line 2, “array” should be --single element--.
- (k) In claim 12, line 3, “elements” should be --element--.
- (l) In claim 13, line 1, “arrays” should be --array--.
- (m) Claim 13 recites the limitation “the imaging system” in lines 2-3. There is insufficient antecedent basis for this limitation in the claim.
- (n) Claim 22 recites the limitation “the electrically conductive target of claim 17” in line 3. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 1-23 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 1, lines 2 and 24, the term “and/or” renders the claim vague and indefinite because it suggests two separate and distinct embodiments.

Further, in claim 1, line 25, the term “may be” renders the claim vague and indefinite because a clear alternative to the condition has not been set forth.

Further, claim 1 recites the limitation “the pitch of said outer elements being selected such that the outer elements are not resolvable” in lines 17-18. It is unclear to which outer elements this limitation refers because the claim sets forth two categories of outer elements, the first including parallel outer elements, and the second including outer elements on each side of and farthest from the central element (see lines 14, 16-17).

Claims 1-6, 17-19, 22 and 23 include all limitations set forth in claim 1, and are therefore considered vague and indefinite.

In claim 7, lines 2 and 25, the term “and/or” renders the claim vague and indefinite because it suggests two separate and distinct embodiments.

Further, in claim 7, line 26, the term “may be” renders the claim vague and indefinite because a clear alternative to the condition has not been set forth.

Art Unit: 2851

Claims 8-10, 20 and 21 include all limitations set forth in claim 7, and are therefore considered vague and indefinite.

In claim 11, lines 1 and 19, the term “and/or” renders the claim vague and indefinite because it suggests two separate and distinct embodiments.

Further, in claim 11, lines 14 and 18, it is unclear how the limitation “array edges” is applied to the single element since an array requires a plurality of elements, and not a single element.

Further, in claim 11, line 20, the term “may be” renders the claim vague and indefinite because a clear alternative to the condition has not been set forth.

Claims 11-16 include all limitations set forth in claim 7, and are therefore considered vague and indefinite.

Further, in claim 14, line 5, the term “may be” renders the claim vague and indefinite because a clear alternative to the condition has not been set forth.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. Claims 1-5, 7-13 and 17-23 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5, 952,160 to Bakeman, Jr. et al.

With regard to claim 1, Bakeman, Jr. et al. disclose a metrology target mask for determining proper lithographic exposure dose and/or focus in a pattern formed in a layer on a semiconductor substrate by lithographic processing comprising:

a mask substrate (mask 80) (see Fig. 4a);

a first, dose and focus sensitive mask portion (left portion of grouped lines 82) on the mask substrate having a first array of elements (group of vertical lines) comprising a plurality of spaced, substantially parallel elements (vertical lines) having essentially the same length and width, ends of the individual elements being aligned to form first and second opposing array edges (left and right sides), the lengths of and spaces between said elements being sensitive to both dose and focus of an energy beam when lithographically printed in a layer on a semiconductor substrate (see Col. 4, line 57 to Col. 5, line 19, Figs. 2, 3a, 3b, 4a; Here it is understood that the lengths of and spaces between the elements are sensitive to both exposure dose and focus when an in-focus exposure is made to the mask substrate.);

and a second, dose sensitive mask portion (right portion of grouped lines 82) on the mask substrate having a second array of elements (group of horizontal lines) comprising a central element (central horizontal line) having a length and a width, and a plurality of spaced, substantially parallel outer elements (horizontal lines above and below the central horizontal line), each having a length and a width, the widths of the outer elements being less than the width of the central element, edges of outer elements on each side of and farthest from the central element forming opposing array edges (vertical sides), the pitch of said outer elements being selected such that the

outer elements are not resolvable after lithographic printing in a layer on a semiconductor substrate and a resulting printed second target portion width is sensitive to dose but not focus of the energy beam (see Col. 5, lines 17-58, Fig. 4b; Here it is understood that the outer elements are not resolvable and a second target portion width is sensitive to exposure dose but not focus when an out-of-focus exposure is made to the mask substrate).

wherein, after projecting an energy beam through the mask and lithographically printing the mask portions in a layer on a semiconductor substrate and determining the widths of the first and second target portions in the layer by measuring distance between opposing array edges in each of the first and second portions, dose and/or focus of the energy beam during lithographic processing of said layer may be determined (see Col. 7, line 54 to Col. Line 7, Col. 10, lines 3-15).

With regard to claim 2, Bakeman, Jr. et al. teach the edges (vertical sides) of the array (group of vertical lines) in the first mask portion as discussed above with respect to claim 1 to be substantially parallel to edges (vertical sides) of the array (group of horizontal lines) in the second mask portion, and the elements (vertical lines) in the first mask portion to be substantially perpendicular to the elements (horizontal lines) in the second mask portion (see Fig. 4a).

With regard to claim 3, Bakeman, Jr. et al. teach the pitch between elements (horizontal lines) of the array in the second mask portion as discussed above with respect to claim 1 to be less than the resolution limit of the energy beam in an imaging system used to expose the mask in the lithographic processing (see Col. 5, lines 43-7).

With regard to claim 4, Bakeman, Jr. et al. teach the second, dose sensitive mask portion as discussed above with respect to claim 1 to include a plurality of outer elements on each side of the central element, the width of the outer elements decreasing with distance from the central element (see Fig. 4a).

With regard to claim 5, Bakeman, Jr. et al. teach the elements (vertical and horizontal lines) of the first and second mask portions as discussed above with respect to claim 1 to comprise opaque elements (chrome elements) on a substantially transparent mask substrate (glass) (see Col. 5, lines 50-8, Fig. 4a).

With regard to claim 7, Bakeman, Jr. et al. disclose a metrology target mask for determining proper lithographic exposure dose and/or focus in a pattern formed in a layer on a semiconductor substrate by lithographic processing comprising:

- a mask substrate (mask 80) (see Fig. 4a);

- a first, dose and focus sensitive mask portion (left portion of grouped lines 82) on the mask substrate having a first array of elements (group of nine vertical lines situated farthest from the right side of the grouped lines 82) comprising a plurality of spaced, substantially parallel elements (nine vertical lines situated farthest from the right side of the grouped lines 82) having essentially the same length and width, ends of the individual elements being aligned to form first and second opposing array edges (horizontal sides), the lengths of and spaces between said elements being sensitive to both dose and focus of an energy beam when lithographically printed in a layer on a semiconductor substrate (see Col. 4, line 57 to Col. 5, line 19, Figs. 2, 3a, 3b, 4a; Here it is understood that the lengths of and spaces between the elements are sensitive to

Art Unit: 2851

both exposure dose and focus when an in-focus exposure is made to the mask substrate.);

and a second, dose sensitive mask portion (right portion of grouped lines 82) on the mask substrate having a second array of elements (group of lines including the vertical line situated closest to the right side of the grouped lines 82 and the horizontal lines) comprising a central element (vertical line situated closest to the right side of the grouped lines 82, and at the center of the grouped lines 82) having a length and a width, and a plurality of spaced, substantially parallel outer elements (horizontal lines) having a length and a width, the outer elements being substantially perpendicular to the central element, ends (upper edge of the horizontal line situated closest to the top portion of the grouped lines 82, and lower edge of the horizontal line situated closest to the bottom portion of the grouped lines 82) of the of the outer elements (the horizontal line situated closest to the top portion of the grouped lines 82, and the horizontal line situated closest to the bottom portion of the grouped lines 82) farthest from the central element being aligned to form first and second opposing array edges (horizontal sides), the pitch of said outer elements being selected such that the outer elements are not resolvable after lithographic printing in a layer on a semiconductor substrate and the resulting printed second target portion width is sensitive to dose but not focus of the energy beam (see Col. 5, lines 17-58, Fig. 4b; Here it is understood that the outer elements are not resolvable and a second target portion width is sensitive to exposure dose but not focus when an out-of-focus exposure is made to the mask substrate),

wherein, after projecting an energy beam through the mask and lithographically printing the mask portions in a layer on a semiconductor substrate and determining the widths of the first and second target portions in the layer by measuring distance between opposing array edges in each of the first and second portions, dose and/or focus of the energy beam during lithographic processing of said layer may be determined (see Col. 7, line 54 to Col. Line 7, Col. 10, lines 3-15).

With regard to claim 8, Bakeman, Jr. et al. teach the edges (horizontal sides) of the array in the first mask portion as discussed above with respect to claim 7 to be substantially parallel to edges (horizontal sides) of the array in the second mask portion, and the elements (vertical lines) in the first mask portion to be substantially perpendicular to the outer elements (horizontal lines) in the second mask portion (see Fig. 4a).

With regard to claim 9, Bakeman, Jr. et al. teach pitch between outer elements (horizontal lines) of the array in the second dose sensitive mask portion as discussed above with respect to claim 7 to be less than the resolution limit of the energy beam in an imaging system used to expose the mask in the lithographic processing (see Col. 5, lines 43-7).

With regard to claim 10, Bakeman, Jr. et al. teach the outer elements (horizontal lines) of the second dose sensitive mask portion as discussed above with respect to claim 8 to be tapered (from the top) (see Fig. 4a; Here the top horizontal line is thicker than the two bottom horizontal lines).

A metrology target for determining proper lithographic exposure dose and/or focus in a pattern formed in a layer on a semiconductor substrate by lithographic processing comprising:

- a substrate (mask 80) (see Fig. 4a);

- a first, dose and focus sensitive target portion (right portion of grouped lines 82) in a lithographically formed layer on the substrate having a first array of elements (group of horizontal lines) comprising a plurality of spaced, substantially parallel elements (horizontal lines) having essentially the same length and width, ends of the individual elements being aligned to form first and second opposing array edges (horizontal sides), the lengths of and spaces between said elements being sensitive to both dose and focus of an energy beam when lithographically printed in a layer on a semiconductor substrate (see Col. 4, line 57 to Col. 5, line 19, Figs. 2, 3a, 3b, 4a; Here it is understood that the lengths of and spaces between the elements are sensitive to both exposure dose and focus when an in-focus exposure is made to the mask substrate.);

- and a second, dose sensitive target portion (left portion of isolated lines 84) in the lithographically formed layer on the substrate having a single element (vertical line) having a length and a width, edges along the length of the single element forming opposing edges (vertical sides), the width of the single element being sensitive to dose but not focus of the energy beam when lithographically printed in a layer on a semiconductor substrate (see Col. 5, lines 17-58, Fig. 4b; Here it is understood that the

a second target portion width is sensitive to exposure dose but not focus when an out-of-focus exposure is made to the mask substrate),

wherein, after determining the widths of the first and second target portions in the layer by measuring distance between opposing edges in each of the first and second portions, dose and/or focus of the energy beam used during lithographic processing of said layer may be determined (see Col. 7, line 54 to Col. Line 7, Col. 10, lines 3-15).

With regard to claim 12, Bakeman, Jr. et al. teach the edges (vertical sides) of the array in the first target portion as discussed above with respect to claim 11 to be substantially parallel to edges (vertical sides) of the single element in the second target portion, and the elements (horizontal lines) in the first target portion to be substantially perpendicular to the element (vertical line) in the second target portion (see Fig. 4a).

With regard to claim 13, Bakeman, Jr. et al. teach the pitch between elements (horizontal lines) of the array in the second mask portion as discussed above with respect to claim 11 to be less than the resolution limit of the energy beam in an imaging system used to expose the mask in the lithographic processing (see Col. 5, lines 43-7).

With regard to the method claims 17-19, the structure of the mask as discussed above with respect to claims 1-3 render the steps set forth in the method claims inherent to the employment of the mask for determining proper lithographic exposure and/or focus conditions.

With regard to method claims 20 and 21, the structure of the mask as discussed above with respect to claims 7-9 render the steps set forth in the method claims

inherent to the employment of the mask for determining proper lithographic exposure and/or focus conditions.

With regard to the method claim 22 as best understood, the structure of the target as discussed above with respect to claims 114 and 15 render the steps set forth in the method claims inherent to the employment of the target for electrically testing image shortening of a pattern.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,952,160 to Bakeman, Jr. et al.

With regard to claim 6, Bakeman, Jr. et al. do not teach the elements (vertical and horizontal lines) of the first and second mask portions as discussed above with respect to claim 1 to comprise substantially transparent elements on an opaque mask substrate. Instead, Bakeman, Jr. et al. teach the elements (vertical and horizontal lines) of the first and second mask portions as discussed above with respect to claim 1 to comprise opaque elements (chrome elements) on a substantially transparent mask substrate (glass) (see Col. 5, lines 50-8, Fig. 4a). However, it would have been an obvious matter of design choice to one having ordinary skill in the art at the time the invention was made to fabricate the mask such that the elements of the first and second

Art Unit: 2851

mask portions comprise transparent elements on an opaque mask substrate for creating a pattern most suitable for the desired imaging effects. Further, applicant has not disclosed that the specific transparency, or opacity, of the elements and mask substrate solves any stated problem or is for any particular purpose and it appears that the invention would perform equally well with the elements and mask having any known degree of transparency, or opacity.

10. Claims 14-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,998,226 to Chan.

With regard to claims 14 and 15, Bakeman, Jr. et al. teach the substrate as discussed above with respect to claim 11 to be electrically non-conductive and the elements in the first and second target portions to be electrically conductive (see Col. 5, lines 50-8, Fig. 4a). Bakeman, Jr. et al. do not teach explicitly the elements in the first array to be electrically connected. However, Chan teaches electrically conductive elements formed on layer of an electrically non-conductive substrate to be electrically connected, wherein upon applying a current across the elements, and measuring the voltage, the suitability of the layer may be determined by the resistance of each of the elements (see Col. 8, lines 31-9). Further, Chan teaches the electrically connected elements to include electrically conductive pads such that current may be applied between the pads, and voltage may be measured between the elements for testing purposes (see Col. 8, lines 31-9). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to apply the testing conditions

Art Unit: 2851

of Chan to the substrate of Bakeman, Jr. et al. for improving lithographic processing of the layer.

With regard to claim 16, Bakeman, Jr. et al. teach the individual elements (horizontal lines) of the first target portion as discussed above with respect to claim 15 to extend in a perpendicular direction from each side (upper and lower ends of the vertical line closest to the right side of the grouped lines 82) of a central element (vertical line closest to the right side of the grouped lines 82) in the first target portion (right portion of the grouped lines 82) (see Fig. 4a).

Conclusion

11. The following prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

U.S. Patent No. 5,476,736 to Tanabe

U.S. Patent No. 6,251,544 to Inoue et al.

U.S. Patent No. 6,340,635 to Toyota et al.


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michelle Nguyen whose telephone number is 703-305-2771. The examiner can normally be reached on M-F 8:30am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Russ Adams can be reached on 703-308-2847. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9318 for regular communications and 703-872-9319 for After Final communications.

Art Unit: 2851

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-4900.

mpn
April 2, 2003



RUSSELL ADAMS
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800